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ABSTRACT

Problem-based learning (PBL) has been used in medical education and has been extended to the preparation of educational administrators. PBL should improve education at the elementary and secondary levels because it can be a vehicle for integrating curriculum, constructing alternative assessments, accommodating instruction for longer blocks of time, and promoting active and group learning. Faculty in three middle schools and one high school (seven teachers and the principal from each middle school and one-third of the high school faculty) were trained in PBL. This paper presented the initial assessments of training, PBL implementation, and the results of its use in grades six through nine. The enthusiastic faculties at first designed PBL activities that were long and complex, but they came to agree that shorter PBLs may be more prudent and effective. A major concern was student difficulty in working in groups. This suggested a need for group process training with students before implementing PBL. Regular schedules required creative planning for PBL efforts. Teachers have reported generally positive PBL outcomes; testing results from spring 1996 will provide information about teacher-reported gains. Success in using PBLs appears linked to carefully planned and relatively brief problems that are reviewed frequently. Appendixes summarize problem types, change process levels, feedback responses, and using PBL in grades five through nine. (Contains two figures, two tables, and nine references.) (SLD)

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EXPLORING PROBLEM-BASED LEARNING (PBL) IN GRADES 6-12

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ABSTRACT

Problem-based learning (PBL) has been used to improve medical education and has extended to education-administrator preparation. Results are generally positive as PBL incorporates tenets of adult learning. PBL should improve K-12 schooling as it is active, challenging, and a vehicle for a) integrating curricula, b) alternative assessments, c) accommodating instruction for longer blocks of time, and d) active and group learning, etc.

The researchers trained faculties in three middle schools and one high school (1995-1996) in PBL. Training procedures differed by site. This paper presents initial assessments of a) training, b) processes of implementing PBL, and c) results of PBL use in grades 6-9.

Enthusiastic faculties at first designed PBL activities that were long and complex; they agreed that shorter PBL's may be more prudent and effective. A major concern was pupil inability to work in groups (share, cooperate). This suggested a need for group process training for pupils prior to PBL work. Regular schedules (50-minute periods) required creative planning for PBL efforts. Teachers reported generally positive PBL outcomes; researchers await the Spring, 1996 testing results to validate teacher-reported gains. Researchers have developed plus/minus factors relative to PBL transference from higher education (adults) to students in grades 6-9.

Note: Portions of this paper are similar to a paper given 3/96 at AASA in San Diego, CA by the same authors, with the title: "PBL as a school-improvement vehicle"; at AERA on 4/8/96 in NY, NY, with the title: "Transforming Administrative Praxis"; at NCPEA, Corpus Christi, TX, 8/96 with the title: "PBL as a School-improvement vehicle."

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Exploring Problem-Based Learning (PBL) in Grades 6-12

Introduction

Problem-based learning (PBL) is gaining credibility and some use in institutions of higher education (IHEs). It's potential for assisting in various ways in school-improvement efforts needs exploration and study. This paper provides a brief conceptual discussion of PBL, the idea of "problem", and one learning model that easily incorporates PBL as a method to move students to high levels of learning.

The second portion of the paper describes one attempt to use PBL in middle schools (n=3) and one high school. Although there are not yet any outcome data (i.e., test scores), there are data on the training and on the teacher-users' ideas about the PBL effort in the grades 6-12 context. The authors plan to continue work along these lines and to obtain some test-scores results that might provide an indication of PBL's potential at least to maintain -- if not to improve -- student achievement levels.

The Problem and A Learning Model as a Basis for PBL

Among those people who have discussed problems -- problems are, after all, the basis of PBL -- three authors have noted striking similarities that deserve attention here. As shown in Figure 1, Getzels (1979, 1985) distinguished between the presented problem and the discovered and created problems; Wagner (1993) differentiated between academic and practical problems; Leithwood (1995) used the idea of routine and well-structured vs ill-structured, and non-routine problems to convey the same general concept as that expressed by Getzels and by Wagner. Essentially, an academic problem has a known solution and method of solution and it is defined and presented by other than the expected "solver." That is, the academic problem is routine and well structured (see discussion of Getzels' problem types in Appendix A). Figure 1 shows some of these ideas.

Although somewhat different from real-life problems, problems used in PBL closely simulate real problems; PBL offers a chance to activate fully one concept of student learning that closely resembles the following model: In Level I, the teacher presents information; in Level II students critique ideas and information; in Level III the students apply the knowledge with the option of guided practice (practice without fear of failure) through the PBL activities. This example as shown in figure 2, suggests that teaching is communication with a purpose and that when a person learns something, the person changes. Thus, the basic elements in figure 2 include ideas of change and of communication. Many classrooms and instructional practices address Level I and sometimes Level II. Through PBL (others might use a case study, PBL allows the student to place the

problem within his/her own context) a student can apply the appropriate knowledge in solving a problem (or even in defining a problem). The use of PBL completes Level III and opens the way to Level IV.

Author	Problem Differences	
	A	B
Getzels (1979, 1985)	Presented	Discovered (created)
Wagner (1993)	Academic	Practical
Leithwood (1995)	Routine, well-structured	Non-routine, ill-structured

Figure 1. Comparison of three conceptualizations of problem types.

Declarative Knowledge →	**Procedural Knowledge** →	**Contextual Knowledge**
I →	**II** → **III** →	**IV**
Awareness/Interest	Trial/Evaluation	Adaptation/Use	Professional Growth
Conceptual Control	Skill building	Skill transfer	Coaching & refinement
Dissemination	Demonstration	Diffusion	Reflection & Growth
Initiation	Implementation	Incorporation	Institutionalization

Figure 2. Paradigm of the Teaching/Learning /Change Model that employs PBL at Level III. (Details of this idea are available in Achilles, C.M. (1986) New perspectives on communication and the change process. Mimeo. Appendix B includes more detail). For the types of knowledge, see Cordiero, P. (1996 AERA).

PBL as a Vehicle for School Improvement .

Parks and Worner (1993) have helped public school faculties use PBL in the K-12 setting. Given changes in K-12 schooling, this use of PBL may be serving a higher good than just preparing administrators. PBL's structure, emphasis on active learning, and potential for excitement for the learner, among other things, show promise for engaging students in middle and high schools.

The rest of this paper explains some recent (1995 and 1996) work to help middle and high school faculties engage in educational improvement by employing PBL. Consider the potential: use of time, cooperation, teamwork, integration of discrete subjects, outcomes for portfolios and authentic assessment, role playing, problem identification, problem solving, "relevance," ways to address "multiple intelligences," demonstrations, independent study, multi-media and technology . . . .

The authors have begun to work in middle schools and in a high school to help educators see PBL as a tool for school improvement. Early results are mostly process and formative, but we anticipate collecting data on such things as student grades, attendance and discipline in the future. Since there are no true "control groups," results will depend on comparison with each school's historical results, comparison to some benchmarks such as state norms or ranks, teacher anecdotes and reports, and perhaps comparisons to results from similar schools where faculties have not used PBL. But, action research is not usually real "tight," and this is just in its beginning stages. Table 1 shows some possible comparisons.

Conceptual Framework

The pioneering work of Edwin Bridges and the writings of Bridges and Hallinger (1992, 1995) regarding the applications of problem-based learning (PBL) in the preparation of school administrators are well known. PBL is enjoying a considerable recognition and some use by a few professors in administrator preparation programs. As the results of applying PBL in the teaching of administrators become known, the use of PBL is likely to spread, although probably slowly. One way to speed up the use of a new technique is to get it out of higher education. This paper discusses one use of PBL and its move from higher education to local schools.

The current wave of PBL interest began when medical educators found that practicing physicians remembered precious little of what they had been taught. There could be several explanations: a) the material they were taught (the curriculum) wasn't appropriate for practice, or b) the method of instruction was so poor that the people did not learn. The third option, a combination of both, is nearly unspeakable. So, medical educators immediately began to seek causes and to find cures. After some problem analysis, leaders at several medical schools, including the prestigious Harvard Medical School, began using a new approach (PBL). In its simplest form, this approach attempts to employ adult learning theory, to use a problem as the center of the instructional process, and to structure learning events around situations as "real life" as possible.

Table 1. Checklist of Use of Organizational, Instructional, and Assessment & Strategies and Techniques Before (Pre) and After (Post) Faculty Training in PBL in One High School and Two Middle Schools in SC (1995-1996).

School and Time	New Use of Time	Portfolio	Demonstrations	"Authentic" Assessment	Use of Technology	Integrated Curriculum	Teamwork and Independent Work	Student Engagement
I. W HS								
A Pre PBL								
B Post PBL								
II Mid. Sch.								
A Pre PBL								
B Post PBL								
III. Mid. Sch								
A Pre PBL								
B Post PBL								
TOTAL								

PBL as applied in adult learning is not just presenting to students a problem; there are some guidelines and some parameters. A problem situation is presented, as are some directions, guiding questions, and some resources to help the student in solving the problem. The student should expand on the resources. Learning objectives are clearly stated, and may relate both to the process of PBL and to the problem under consideration. The problem is so framed that product specifications give guidelines for the response that may be a written report, an oral presentation, or some other way to convey the solution to the problem. Criteria are provided for evaluating both the process of solving the problem and the solution that has been determined. All of this is wrapped into a realistic time frame. That is, the problem solver has constraints of time to deal with, just as the person would face in real life. Given these structures, and the interest provoked by the problem, the problem solver or problem-solving group will proceed to some conclusion that is then made public through the product specifications. Usually people work as teams to get the recommended solution. Team roles include such positions as leader, recorder, facilitator, and group member.

As data are being collected and analyzed on use of PBL in higher education, people are beginning to see the utility and benefits of PBL in administrator preparation. This makes sense, particularly as PBL is fashioned on tenets of adult learning theory, and most people preparing for education administration are adults. Yet, the challenge of working on a problem, the thrill of seeking solutions to interesting conundrums, and the emerging interest in teamwork in schools has lead some people to ask about the application of PBL to improve schooling in high schools, or even in middle schools where very energetic students often function in team settings as part of the school structure. (See Parks and Worner's work, 1993.)

Since PBL is primarily a method of delivering instruction, it can be expanded to encompass many learning modalities, including most of Gardner's (1983) "multiple intelligences" within a PBL lesson activity. The current trend toward school restructuring provides considerable opportunity for creative and productive use of PBL, particularly as the following things are occurring:

1. Instructional days are being restructured into longer periods and even alternate-day scheduling, leaving teachers with long blocks of time for instruction.

2. Faculties are employing "school-to-work" initiatives that help youngsters plan for future employment. Activities sometimes rely on students working in teams, to produce products, and to model behaviors and skills; and

3. "Authentic assessment" ideas are requiring new kinds of student products or outputs that can become part of a portfolio or some other basis of student evaluation.

Can a PBL format give flexibility to encompass some of the new restructuring ideas while emphasizing active learning in classrooms? As with other new instructional modalities, this probably will not occur smoothly unless teachers have some opportunity to learn the skills in a staff development activity and to practice without fear of failure. The staff development cannot be a "one-shot" effort but must incorporate ideas of adult learning: one element of staff development might well be a PBL activity to help teachers understand the problem, "What is PBL?" This structured staff development approach has been tried in middle and high schools in South Carolina as a basic way to teach teachers to use PBL in their classrooms.

Structure of Staff Development

Each of the staff development activities for teachers in the local schools began with dissemination of information about PBL as a way to generate awareness or to cause consciousness raising on the part of the target audience. Activities then moved to opportunities for observation and demonstration, with a question-and-answer session and a critique of the PBL process used to instruct teachers about PBL. These steps were accomplished though video processes, by role-play, and from other procedures whereby teachers reviewed PBL packets and critiqued them while learning about them. The final stage has been group support as teachers work with students to develop PBL activities and to determine if the application of PBL in their public school classrooms will improve student learning and deportment.

Prior to the workshops, teachers received materials that they should read to learn something about the background of PBL and some evaluations of PBL's efficacy in administrator preparation as well as in medicine. They also received information asking them to try to conceptualize the carry-over of PBL from an adult activity to learning efforts in their own classrooms, grades 6-12. During the first few hours of the face-to-face in-service sessions, teachers viewed videotapes, reviewed PBL packets from other systems, and reviewed the PBL-structure packets designed by Parks and Worner (1993) for use in school systems. These packets became the focus of discussion and critique so that teachers could understand the elements of a PBL exercise and could understand how the resources and other key components fit together as a learning modality. As the last activity of the first day of PBL work, teams of teachers began to sketch out plans for PBL packets that they could develop for use in their own schools. The PBL packets had to relate to the school goals and objectives and to the curriculum of the particular grade level. Teachers were encouraged to find facts and other things that could be taught thoroughly and easily in the PBL format and to think about the inter-relationships of several themes so that the PBL activity could integrate disciplines such as social studies, science, language arts, mathematics. Teachers were encouraged to design product specifications that

would allow youngsters a variety of ways to convey what they had learned, such as writing, speaking, video, audio, drawing, etc.

At the one high school in this study, one master teacher attended every session and as each day progressed, that teacher took over more and more of the presentation responsibility. In this way, we hoped that one teacher would become a "teacher trainer in residence" who could answer questions from other teachers, provide follow-up, or at least collect questions and contact the trainers for answers. In the middle schools, follow-up was provided by the trainers themselves who returned to the school district and worked with the teams of teachers approximately 12 weeks after the original two-day presentation of PBL. At this time the teacher teams had already completed a PBL with students or had designed outlines of their PBL activities, including some of the resources, learning objectives, and product specifications. After discussing PBL progress, the trainers helped the teachers critique their own materials and asked them to return to school, complete the unfinished packets, and use them with at least one, or even better, with two or three groups of students.

Why It's Time

Secondary school curriculum in the 1990s is so broad that no amount of time management and effective planning of teachers can ensure that all content areas are taught inclusively. With knowledge multiplying every few years, and with hours in a day constant, what are teachers to do? Furthermore, educators are restructuring course offerings to include more career exploration to be part of the traditional curriculum. Instructional periods are being reconfigured. National goals and curriculum, frameworks for learning, and higher-order thinking skills (HOTS) are prevalent terms that often expose "traditional" schools as stagnant teacher- and content-centered, isolated deadends to learning. Added to the frenzy of criticism of public schools and teachers are student apathy and disengagement. Multiple-choice questions are being replaced with application and demonstration assessment scenarios requiring students to show proof of their analytical abilities and knowledge mastery. Always guessing "C" is quickly becoming an obsolete option.

"Technology" is identified by some as the most sophisticated network of international knowledge accessibility and by others narrowly recognized as a complete classroom set--with all of the parts operable--of hand-held calculators. Complicating this nebulous dilemma is the dearth of "on-line" technology-trained teachers. For those who avidly believe that "technology" is a teaching method, PBL is probably a learning method too easily overstepped, overlooked, and underused. Like technology, PBL is a vehicle for transporting knowledge . PBL is a much needed teaching method not only in higher education but also in public schools because it supports, uses, and advances a restructured curriculum

emphasizing HOTS, people skills, communication skills, technological resources, and learning applications. Teachers, textbooks, and technology work in harmony with students to uncover and apply the data of the learning problem.

The teacher's role is transferred from traditional "expert" to "colearner" or cicerone in a nonthreatening environment. Teachers employing PBL employ flexibility in curriculum content while meeting benchmark standards of achievement, chiefly by encouraging students to be more responsible for their own learning. Use of PBL helps educators shift the emphasis *from content* -- with book, paper, and pencil -- *to process* -- with thinking, questioning, and exploring and from teacher as lecturer to student as worker. Teachers promote metacognition as the goal, not rote memorization of facts. With new knowledge growth overwhelming schools' financial abilities to provide timely hands-on teaching tools and resources, PBL is a large umbrella to house different methods to discover knowledge. It isn't a "thing"; it is a process, a method.

One current buzz-word in curriculum is "integration." Much like the teacher and students of one-room schoolhouses or even of elementary self-contained classes, today's teachers and students touch almost every subject in order to learn new material. *Thematic* presentation of material addresses integration. Teaching content in isolation is unacceptable if students are to apply knowledge in relevant ways that are useful to them. More and more, secondary teachers are not only returning to thematic content organization but also to team teaching these thematic approaches. Middle school educators have long been teaming advocates, and, fortunately, many high school educators are now employing school-within-a-school (SWAS), teaming, and cooperative teaching and learning methods to make content more student-directed, thematic, and integrated.

The PBL approach offers the benefits of both a classical and a pragmatic curriculum. For an education purist, PBL supports the philosophy of "learning for learning's sake" as students simultaneously discover the benefits of fine arts, sciences, humanities, and even vocational studies.

For the pragmatist, PBL has a core goal· to discover a truth, to answer a question, to devise a solution. In one PBL project, students addressed multiple curriculum benchmarks while exercising life skills of cooperation, compromise, and communication. This can be a significant accomplishment when neither the religious right nor the liberals object! While the debate rages on about the merits of pragmatic Tech Prep, school-to-work, and applied academics, PBLers use traditional textbooks, cutting-edge technology, exploration, resources, and communication skills to make information relevant to the total education package.

South Carolina, like other states, is mandating curriculum restructuring to include more strenuous academic requirements and more career-based

exploration and skills. Some educators argue that these two goals are different and address the needs of separate student audiences; however, by employing PBL as one teaching methodology, educators easily provide for the needs of both student types by reinforcing certain skills common in all successful people: 1) analytical thinking; 2) teamwork and group skills of collaboration and compromise; 3) varied communication methods; 4) inquiry; 5) application and demonstration of outcomes; and 6) questioning. Surely not only the college-bound student needs HOTS, analytical reasoning, and communication abilities for varied audiences. Surely, too, career-bound students are not the only ones who need to know how to apply knowledge to create or demonstrate a new product or solution. As technology genres spawn in everyday life, all people -- mechanic to physicist -- need to develop more uses for isolated bits of information. PBL encourages this sharing of information in user-friendly, classical, and pragmatic educational philosophies and methods.

The PBL Players

Three South Carolina schools, Woodmont High School in The School District of Greenville County and Howard Middle and Brookdale Middle in Orangeburg School District 5, experimented in different PBL training and implementation. Woodmont, located in upstate SC, houses 880 students in a rural setting with the students primarily coming from lower-middle income brackets and difficult to motivate for academic success as evidenced by average and below average standardized scores. Both middle schools of about 700 students each are located in the center of the state and have primarily minority populations. Test-score achievement, while bordering in the average range, also needs improving. Nothing detracts from these schools' being "typical" of many in their populations, pleasantries, and problems.

Middle School Training and PBL Endeavors.

Each of the Orangeburg middle schools sent representative teams of seven teachers and the principal to three days training. In summer 1995, two consecutive days of training concentrated on school profiles and achievement needs, current and desired levels of curriculum integration, the basic format training, and group PBL planning. The teams met additionally over the summer to finalize an early fall PBL of their choice. In November the teams assembled for the third training day to report progress, clarify processes, evaluate methods, and plan future PBL use in their settings.

Brookdale Middle School educators had planned two PBLs and had almost completed one, "Knowing Your State." The product students developed was a portfolio of local and state resources. The objective was to teach state geography

as well as to expose students to state resources unfamiliar to many. Some students, living only two hours from the Atlantic Ocean, had never been to South Carolina's beautiful beaches, did not know anything about South Carolina's historic landmarks, and knew little about the state's industry, economics, government, and geographical layout.

Brookdale teachers responded favorably to their results. One teacher evaluated PBL as "a method which requires higher order thinking ... and ... provides the children with success." She commented that students were eager, often too loud in their enthusiasm. She said, "Achievement has gone up because all of the students felt successful." Students used traditional resources: atlases, encyclopedias, reference books, etc. The major difference in learning how to use these references was a unified academic purpose and application instead of isolated drill. Students understood the *why* and *what* of an atlas, for example, when searching for information for a particular purpose.

Howard Middle School educators intrigued their 6th, 7th, and 8th graders, the "Bruins," through an integrated language arts and social studies PBL entitled, "Howard's Expedition." This PBL encompassed three weeks' time and concentrated on library resource and research skills required in the middle school's curriculum. Complete with an artistically designed cover sheet, middle schoolers were hooked on the PBL cover sheet with its lead:

> *Today, Baby Bruins are forced to leave familiar grounds because of pollution and ecology problems. Students from Howard Middle were asked to search for a safer and healthier environment. You will want to keep a portfolio of your journey...*

Howard 8th grade students wrote of their PBL expedition:

> *I like this project because it is very interesting. It makes you go research many different things.*
>
> *"Howard's Expedition" is a unique and challenging project. You have to be creative. Research is very important.*

A Howard teacher wrote that the PBL was an "excellent motivation" for positive classroom behavior and student participation. Encouraged by these participants' opinions, Howard teachers began planning another PBL on South Carolina Native Americans.

High School Training and PBL Endeavors

Training at Woodmont commenced in spring 1995. Each day for three consecutive days one third of the entire faculty learned the basics PBL. On each day one teacher and the school's principal assisted the trainers in order to be on-site resources and liaisons for the teachers and trainers. Training included a summary history of PBL, group role expectations, sample PBL exercises, group processing and reporting, and large-group recapping. Following this training, teachers began planning PBLs for the 9th grade SWAS with released time and summer stipends provided through professional development funds.

Woodmont High School is located between two tiny communities, Moonville and Possum Kingdom. Playing on the local color of the area's names, the teachers created the PBL "Beyond Possum Kingdom." All 9th graders (n=300) and teachers (n=10) in the SWAS planned imaginary three-week family vacations across America. Students had travel budgets, cars, and a series of typical vacation dilemmas and windfalls to incorporate into their 3500-mile journey. English, social studies, math, and science teachers set respective discipline requirements for families to enjoy (or to endure!). Mastery of letter writing, persuasive family communications, scientific journals, map reading, museums, national parks, recreational sights, menu planning, budgeting, -- even trip hygiene peculiarities (clothes washing for 4 people: whose job; what city; when; how much?) -- were part of academic goals and life skills considerations of this extensive two-month effort. Portfolios--the academic version of vacation slides -- personal travel journals, group oral reports, and other group-tailored assessments evaluated the student work.

Teachers completed an individualized and group PBL feedback (see appendix) when "Beyond Possum Kingdom" concluded. One social studies teacher believed that the academic objectives particularly helped students understand the project's purpose. She commented that the project's scope often overwhelmed but motivated students. She offered the suggestion to break down due dates for smaller assignments within the PBL format. She also wrote:

> *PBL is an interesting approach to teaching. Students learned without knowing they learned. This approach is difficult to plan but with the team we had, ideas flowed freely, and much was accomplished in a relatively short amount of time.*

A math teacher met with obstacles. She said participation was decreased because family members were not together in math classes and that "students wanted to work alone." However, she wrote, "Achievement went up.... pre- and post-tests covering the objectives showed a significant increase was made."

The uses of PBL touched South Carolina's extensive efforts to support Tech Prep and School-To-Work curricula. The math teacher saw PBL as a support to other curriculum programs. She commented:

> *As a teacher of "Math and Science in the Work Place,"...PBL is an effective instructional approach because it is used in industry; i.e., team approach to finding a solution using resources.*

A common response dealt with students' cooperative natures -- or lack of them.

> *My biggest problem had to do with personality conflicts ... communication problems.... However, some groups worked like a finely oiled machine; they shared...research and responsibilities. Those students who ran into difficulties learned a valuable lesson about the nature of human relationships.*

The teacher added that he felt confident teaching PBL and that he plans to develop other integrated projects. He summarized many teachers' responses with:

> *Yes, it can be fun because as I taught this PBL, I started feeling more like a coach that a teacher. I think this is good.*

What We Learned

Despite the training approach used -- one day or three -- or the audience type -- middle or high school teachers -- remarkably similar conclusions, teacher frustrations, student successes and failures, and project benefits emerged. Inherent in them were the influences of teacher receptivity to change, personal and school interest in nontraditional approaches, and commitment to individual and team responsibilities. The PBL for the teachers was learning *how* to plan, navigate, and negotiate a PBL--complete with all of the teamwork obstacles their students encountered. A summary of these teacher and trainer conclusions is in Table 2.

Conclusions and Recommendations

The overwhelming chorus from the three groups of teachers was that students lacked adequate social skills needed to process group work efficiently and effectively. Middle and high school teachers all were amazed that students were so distrustful of each other, wouldn't "share" or willingly cooperate, and

often displayed a "me or them" attitude of survival. (See Appendix D for some supporting ideas). Getting to the heart of problem-solving took a back seat to people skills. In a nutshell, -- *people, not programs* -- often had to be the priority teaching emphasis.

In interviews the teachers emphasized that new PBLers needed schooling in social skills related to group processing, active listening, taking turns, using good manners, and even demonstrating appropriate body language. Ironically, the teachers had a microcosmic insight into the "X Generation" when groups of four adolescents could often not even reach a calm consensus on determining a trip destination; "control" (power) was a major issue with the students. The middle school teachers also said that boys more than girls withdrew emotionally and academically, in group situations; girls tended to participate more readily in the PBLs. The leaders surmised that PBL activities demanded more talking, more creative responses -- more social engagement in an "academic clique" environment. The girls tended to dominate these areas.

PBL was an effective vehicle for addressing varied learning styles. All projects required products resulting from research, communication skills, and applied knowledge. All required written and oral presentations as well as some form of kinesthetic involvement: drawing, assembling, acting, etc. Instructional pacing, student learning, and assessment procedures were different for all projects, and could also vary within the individual PBL group activities. Student groups had some autonomy over these decisions; teachers were not sole controllers.

All teachers felt bound by the constraints of a school-day schedule. PBL requires extensive planning, and adequate time could not be found in the average day for orchestrating a PBL. Teacher teams did the majority of their preparation after school, nights and weekends. All agreed they were exhausted -- but invigorated -- by the PBL experience. In regards to planning, they also concluded:

1. Keep PLBs short--two weeks or less, at first, until format is perfected.

2. Plan in "off" times--not during a packed school year; implement and revise during the year.

3. Process, review, and brainstorm constantly. Keep a log of "do's and don'ts" of each PBL; teams forget over a year what to keep or throw out about activities.

Table 2. Positive and negative comments after one use of PBL: S.C. Schools

+	-
• PBL format incorporated "fun" learning activities with more " serious" basic skills foundation.	• Students didn't know group behavior skills or etiquette.
• The professionals enjoyed exciting "teacher-teaching" experiences: integrated curriculum, new knowledge.	• Girls responded more positively than boys to most group activities or team requirements.
• Varied assessments procedures were available, using all types of communication and thinking skills.	• Students' thinking process and work skills were unrefined, resulting in their frustration.
• Students had opportunities to know each other, learn to trust and to depend on each other.	• Format required extensive teacher team-planning, consistent monitoring and adjusting, and new teaching methods.
• Students learned more about responsibility and work ethics.	• Teachers did not know that their "Traditional" secondary university programs prepared them for professional teamwork skills, integrating sophisticated curriculum, or employing authentic assessment procedures.
• Students took pride in their PBL work products: trip itineraries, reports.	• Students, parents, and other teachers didn't always understand why the "old" approaches of isolated instruction needed to change: the " old" was comfortable.
• School and district administrators were encouraging and supportive of expanded teaching methods and needed staff development.	• PBLs can drag out too long, be too ambitious, and can bore students and teachers with endless details and logistical dilemmas. Keep it simple and short (KISS), preferably to 2 weeks and with only a few teachers involved
• Achievement improved because students usually participated more in learning activities.	• Objectives and timelines needed more clarification than first believed; students were often overwhelmed.
• PBL motivated most students to participate, curtailed disruptive behavior, engaged students in learning.	• More upfront time is crucial to ready supplies, to bond with group, to practice skills, etc., *before* PBL begins.
• Life skills were emphasized: responsibility, teamwork, communication, respect.	
• PBL was a painless way to learn.	
• Department improves: general classroom behavior and social skills awareness.	

4. Teachers need to work on group processing and team skills just as students do! Teachers appeared to work harmoniously; however, all agreed that PBL teacher "families" would end in "divorce" if prenuptial agreements weren't in place to keep the decision-making process running smoothly.

5. Regardless of the outcomes, do another PBL soon. The middle school teachers decided to enlarge their PBL activity; they had worked with a reasonably contained problem, a short time frame, and a specifically targeted audience. The high school teachers concluded to divide into subgroups to implement new PBLs with smaller topics, fewer students, and a shorter time frame. For example, an English and a science teacher began a PBL emphasizing scientific exploration, research, and technical writing with approximately 60 students...not 300 supervised by 10 teachers as in the first attempt.

Implications for Practitioners and Professors

School-to-work, applied academics, career exploration, Back-to-Basics, Higher-Order-Thinking-Skills...whatever the buzz word, or current politically correct jargon, practitioners are searching for ways to teach more and better with less, to often unmotivated students. The traditional lecture and work-sheet approach in an isolated teacher-down power hierarchy has not produced an abundance of problem solvers or even masters of basic skills. Something has to give, but it shouldn't be the people or their spirit. Then, what? Methodology has to change. PBL isn't the answer, but it permits flexibility, encourages the dying arts of communication and mutual respect, and showcases students' talents. Simultaneously, it takes the components of each academic discipline and blends them. The product is greater than the sum of the parts.

High school teachers may have difficulty integrating curricula because of the complexities of various disciplines and professional "stuck-in-a-rut" attitudes. Middle and high schools teachers discussed here wanted to explore, to learn new methods; however, they experienced frustration, mainly because of the "system's" limitations. Schools are not always "learner friendly" if the learners do not learn as educators traditionally demand. In reality, though, the tools of our trade are at our disposal if we know how to use them. Teacher guides do not incorporate curriculum objectives; teachers must. Planning doesn't just occur; teachers must do it. Administrators can't just give isolated days and days of school time for staff development; they must make staff development happen within the hub of the school. These professionals were *willing to change*.

University teacher preparation programs might now review traditional methodology courses to incorporate them into core academics: Learn to teach

science while you study science; learn to teach group skills by being a member of a learning group. Secondary teachers may need more exposure to learning theories and methodologies through a humanities core. Methods classes as well as directed teaching experiences may need more emphasis on developing instructional and assessment approaches. More attention to assessing student learning styles and viewing problem-solving as a needed academic skill may be missing elements in teacher preparation that would skyrocket an approach like PBL.

With the push for curriculum "relevancy," one teacher summarized that PBL prepares students for lifelong skills. Are life skills more relevant than curriculum? Can life skills and curriculum be combined within an academic setting? People need to know the language of numbers, to write and read, and to know how to get by in the world. Relevant thinking processes to match the emerging questions of school, work, and life in general might be more of an appropriate emphasis than the nebulous concept of "curriculum" without relevance. As one Woodmont teacher so aptly wrote of PBL:

> *It would be neat to have the whole curriculum planned into thematic unit that were problem-based That would bring reality (life) and fantasy (school) closer together for the student. Relevance is such an important factor in achieving student motivation. I suppose that if I were to seek additional training it would be in seeking activities designed to strengthen student participation in the cooperative roles.*

❦❦❦❦❦❦❦❦

POST SCRIPT

Appendix D contains sample of the worksheets from one of the inservice sessions. These notes were used to get the middle-school training underway. Also in Appendix D is a national comment in the phenomenon both sets of teachers reported regarding the inability of students to organize and to get along in the PBL cooperative environment.

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APPENDIX A

Summary of Getzels' Three Problem Types

Getzels (1979: 7-8) notes that there are numerous types of problems. He then identifies three types of problem situations.

1. PRESENTED PROBLEM SITUATIONS. The problem is given to the problem-solver. it probably has a known formulation, known method of solution, and known answer. The problem is proposed by someone else and given to the problem-solver. (This is the situation most prevalent in schools. Think of all your classes and subjects. Given that the side of a square I four feet, what is the area?)

2. DISCOVERED PROBLEM SITUATIONS. The problem exists, but is formulated by the problem solver, not by someone else. It may not have a known formulation, known method of solution or a known solution. Why do children, at about grade 3 or 4, begin to seem to dislike school when almost all children are initially eager to attend school? Is this an American education phenomenon, or does it exist in other cultures?

3. CREATED PROBLEM SITUATIONS. No problem is evident until someone creates or invents it. An artist creates a painting. A poet expresses beauty through an ode. An advertising artist may be given a problem -- design an illustration for an advertisement. A fine artist starts with a blank canvas and proceeds to create a problem which the same artist then moves to solve.

(Getzels, 1979: 7-9).

APPENDIX B

	CHANGE PROCESS LEVELS			
Description and Communication Act.	I	II	III	IV
Message (Purpose)	Understanding. Conceptual Control	Skill Building. Expanded Knowledge Base.	Transfer of Skill and Knowledge.	Application of Skills and Knowledge. Relationships
Relation to Change	Awareness/Interest; Initiation. Dissemination	Trial/Evaluation; Implementation. Demonstration.	Use/Adoption; Incorporation. Diffusion.	Institutionalization and Renewal
Method(s) and/or Media				
Targeted Audience				
Mode(s)				
Assessment Strategies				
Learning Style(s)				

A suggested communication/change model to guide leadership actions in decision-making and change. The model suggests ways that the change may be initiated and monitored. Terms are combined from several authors: Rogers, 1962; Rogers & Shoemaker, 1983; Achilles & Norman, 1974; Berman & McLaughlin, 1974 and 1978.

Appendix C: PBL Feedback Summary.

We'd like your reactions to the "PBL Experience. "
Please be as detailed as possible.

I. How many PBL "events" or sessions have you:

A. Planned? Which ones?
B. Taught? Which ones?
C. Completed and evaluated? Which ones?

II. For the PBL "events," did you include:

A. "Specifications" or product outcome (What you want)? What?
B. Learning objectives? . Addressing what main topics?
C. Time frame (due date)? Duration? (2 days...2 weeks...)
D. Sample resources or directions where to locate resources? What Type?

III. What has been the student response to PBL in terms of:

A. Behavior
   1. Eagerness (motivation)
   2. Participation
   3. Discipline

B. Outcome or Work
   1. Were assignments done punctually and completely?
   2. Did each person contribute?
   3. Did you encounter problems teaching and employing the cooperative roles (leader, facilitator, recorder, group member) ?

IV. Has student achievement gone up, down, stayed the same? (Please describe)

V. What strategies have you used to evaluate student participation and/or student outcome (product) ?

VI. Do you need additional training in PBL? In what specific areas?

VII. Please comment on PBL as an instructional approach. Is it fun? Do the students like PBL? Do you like PBL as a strategy? What is the most difficult part of teaching PBL? Does a PBL take more planning than other methods? Is it worth the efforts--in terms of student and teacher satisfaction? Is PBL the "same old thing" or an innovative approach to relevant, integrated learning? Did your university train you effectively for PBL skills?

APPENDIX D

USING PBL IN GRADES 5-9

A Report on Problem-Based Learning (PBL) training and reporting sessions, Middle School Teams at Orangeburg District 5 on June 26, 27 November 4, 1995 and High School Team at Woodmont H.S., School District of Greenville County, SC. on May 22, 23, 24 and November 6, 1995.

Facilitators:

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Introductory Notes:

At Woodmont, H.S. training was for the entire faculty, all day one day for each of three groups. One person became the "in-house" expert and attended all three days. At Orangeburg, two middle-school teams received three days of training. Both groups had follow-up to see how they were doing.

The attached are copies of our brainstorming and refining of the middle-school application of PBL. We have transcribed responses exactly as given in class, with no further explanation submitted. At the wrap up, we asked the group to please reflect upon the responses for current clarity and for relevant application of PBL as part of an integrated curriculum relying on student motivation, teamwork, responsibility, and demanding academic responsibility.

To begin the session we asked people to consider their contexts, issues, concerns, etc. This information would be a basis for the planning and development of PBL. After the brainstorming, we placed "Think Sheets" around the room so participants could list and comment on their concerns etc.

✓ = Brainstormed responses that were repeated in the first formal reports on using PBL in the school setting as an effective, motivating, and results-oriented methodology.

Lead Questions

1. **How would you describe the "typical" middle school learner?**

	visual		disorganized
	energetic		loving
	difficult		in love ♥
✓	wishy-washy		moving
✓	"psychotic"		unpredictable
	sensitive		daring
✓	hormonal	✓	argumentative
	playful		concrete
✓	loud		

2. **Why is it difficult to foster life-long learning within students in regards to <u>our</u> current, traditional teaching methods?**

✓	indecisive	✓	"more & more" syndrome
✓	segmented curriculum	✓	lack of integration
✓	less reading	✓	less discipline
✓	visual	✓	different playing field
✓	environment	✓	lack of attention span
✓	focus	✓	instant gratification
✓	relevance		

3. **What are some problems related to student responsibility for their <u>own</u> learning?**

✓	lack of responsibility	✓	family structure
✓	lack of motivation		traditional rewards
✓	no priorities	✓	peer pressure
✓	low self-esteem		negative media
			permissiveness of general society

4. **What most hinders you, your school, and this school district from being more effective in teaching and learning?**

✓	funds	✓	discipline (lack of)
✓	parent involvement	✓	priorities
	legal aspects	✓	lack of standards enforced
✓	class size		lack of consistency
✓	unwillingness to change		media hype
✓	lack of dedication (some)	✓	teacher training programs
✓	pressure	✓	team work
✓	anxiety		paper work
✓	too many roles		meetings
✓	training		

Think sheets

Opening

1. - Do we use or abuse time?
   - "You can teach knowledge but not wisdom". (Hesse)
   - Change can be good (and painful).
   - Great Group !!

Film

2. - In light of PBL, how should our own traditional teacher preparation programs be changed?
   ? earlier exposure to teaching and school life?
   ? different teaching methods in universities to teach different teaching methods ?? (HA! ☺)

   - When should students be exposed to PBL?
     ? middle school?
     ? elementary school? HOW ?

   - PBL: The same but different! ☺

Work Session and Reports

3. - Is there a difference between "classroom teacher" and "professional educator"?

4. - How are teams selected?
   - How would this work for regular classroom teachers?
   - PBL: Higher Order Thinking Skills!!
   - Structure for new learners
   - Fostering student cooperation

Closing

5. - How do PBL and cooperation learning differ?
   - "How do I adapt PBL to my world?"
   - PBL Successes?
   - PBL Needs?
   - "Life in South Carolina" [1]
     - Who said, "How about and M&M sandwich with 'maters' and mayonnaise?"
     - Pork 'n Bean sandwiches
     - Spaghetti sandwiches

---

[1] Workshop presenters are not responsible for the culinary requests or gourmet quality of participants. (We prefer banana and potato chips with Duke's -- on white bread or Gourmet Road Kill du jour).

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